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The Effects of Spoken Accent on Verbal Working Memory Performance

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The Effects of Spoken Accent on Verbal Working Memory Performance

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Committee Members: Larry Aslin and Aletha Cook

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ABSTRACT:

Language diversity is continually increasing in the United States. In the 2007 American Community Survey taken by the U.S. Census Bureau, it was found that about 20 percent of the U.S. population spoke a language other than English at home. As language diversity increases in the country, the language diversity of individuals diagnosed with cognitive or communicative impairments also increases. As a result, understanding how language and spoken accent difference affects the accuracy of diagnostic testing becomes an important question. A large challenge facing speech-language pathologists regarding culturally and linguistically diverse clients is distinguishing communication differences from communication disorders. As the language background of the test-takers vary, the potential for misdiagnoses becomes a greater issue. While it is mandated by the Individuals with Disabilities Education Act of 2004 that testing be completed in both the native language of the test-taker as well as in English, the spoken accent of the test administrator remains a variant. This study is designed to assess whether the spoken accent of the test administrator has a significant effect on the test-taker's recall ability. In this study, the Number Sequencing subtest in the Fourth Edition of the Clinical Evaluation of Language and Fundamentals (CELF4) test and the Number Sequencing subtest of the Test of Auditory-Perceptual Skills- Revised (TAPS-R) were used to measure verbal working memory performance of 20 college students of ages 18-26 who speak, and are predominately exposed to, Mainstream American English. The Number Sequencing tests assess an individual's ability to recall a verbal list of numbers, both forwards and backwards. The test provides raw and standard scores according to naming accuracy (percentage). Each participant took both tests from two different test administrators. Two male graduate students of similar age administered the tests; one with a native language of Mainstream American English and the other with a native language of Kurdish. Both test administrators are proficient in English, though their spoken accents differ. The participants acted as their own control, meaning their raw scores from both tests will be compared to identify if the spoken accent of the test administrator had a significant effect on their test performance. Overall the results indicated that spoken accent has no significant effect on recall ability. There was no noticeable trend between each participants scores and the spoken accent of the test administrator. There were a few limitations to this study; one being the high predictability of the test material. In future studies, test items with more semantic information would be a better representation of how recall ability is affected by spoken accent difference.

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LIST OF ABBREVIATIONS:

WM: Working Memory

LTM: Long-term memory

L2: Second Language

L1: First Language

SLPs: Speech-language pathologists

ELL: English Language Learner

CELF4: Clinical Evaluation of Language and Fundamentals Fourth Edition

TAPS-R: Test of Auditory-Perceptual Skills- Revised

T1: Trial 1

T2: Trial 2

The effects of spoken accent on verbal working memory performance

Background/Introduction:

Working memory (WM) is “a limited capacity system allowing the temporary storage and manipulation of information necessary for such complex tasks as comprehension, learning, and reasoning,” according to Alan Baddeley (2000, p. 417). Without proficient working memory, new information cannot be properly comprehended or committed to long-term memory (LTM), which affects an individual’s capacity to learn. The mechanism of WM is explained by a model proposed by Alan Baddeley and Graham Hitch. This model suggests that there are four components to WM: the central executive, visuospatial sketchpad, phonological loop, and episodic buffer (Baddeley & Hitch, 1974). These are displayed in the following figure:

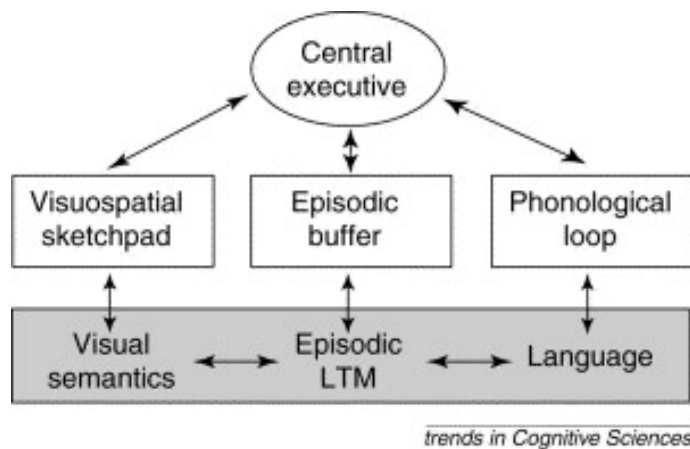


Figure 1. Visual aid depicting the process of WM.

The central executive is the cognitive attentional control system in an individual, which includes the individual’s capacity to decide which incoming stimuli to attend to as well as the allocation of incoming stimuli to the visuospatial sketchpad and phonological loop. The visuospa-

tial sketchpad deals with visual and spatial/relational information and memory while the phonological loop deals with speech perception and speech production. The episodic buffer is a recent addition to the WM model which communicates with both WM and long-term memory to aid in the comprehension of the incoming information and stimuli. As this information is held in WM, it is referenced to past experiences and knowledge held in LTM and then categorized by these connections to aid in sufficient comprehension and efficient storing in LTM. All of these processes work together to properly store and analyze incoming information. WM will use elements from both the phonological loop and the visuospatial sketchpad to rehearse and recall incoming visual and/or auditory information, increasing WM proficiency (Baddeley, 2000)(Baddeley & Hitch, 1974). This is evident in the study by R. Conrad and A.J. Hull, where participants were administered a visual working memory test in which a list of letters were briefly depicted and then participants were asked to verbally recall the list. The study found that participants' ability to recall decreased when the list of letters were acoustically and phonologically similar in their names (i.e. B, C, D, G, E) as compared to a list of letters whose names were not similar (i.e. B, H, L, M, S). This indicates that the participants used a subvocal rehearsal system to retain the information even though it was presented visually (1964). These findings suggest that the phonological loop evolved to assist in language acquisition (Baddeley, 2003). A study done by E. Service found that children with a good verbal WM were able to retain vocabulary and syntactic rules from a second language (L2) faster than children with average or below average WM (1992). Similarly, many studies have found that a larger WM capacity correlates with faster L2 acquisition (Miyake & Friedman, 1998).

In a recent study done at the University of Tennessee, Knoxville, results indicated among Korean-English speaking children grades 1 through 4 WM capacity is independent of the language used for testing. They were administered WM tests in both English and Korean by native speakers and all scored similarly on the tasks. When the WM evaluations involved language processing under real learning conditions, however, the scores received were dependent on the language used. The children scored more poorly when the weaker language was used (Park, Schwarz, & DeLozier, 2008). WM proficiency is a large indicator of academic success as its capacity indicates learning capabilities. If WM is compromised, the ability to comprehend and recall new information decreases, hindering academic performance (Baddeley, 2003).

Purpose:

The purpose of my research is to identify if the spoken accent of the individual presenting the information has a significant effect on working memory performance of the listener. This study can have numerous implications. As American universities become increasingly diverse, a greater population of students and teachers are non-native English speakers. According to Project Atlas, in the 2011-12 academic year, a total of 764,495 international students were enrolled in the U.S. This enrollment total increased to 886,052 in the 2013-14 academic year and the numbers continue to increase. Working memory proficiency is essential in classroom instruction, in which students are expected to retain and learn new information through verbal lectures. If verbal working memory is compromised, it can decrease retention of new information and possibly cause difficulties in academic success. This study is designed to better understand the effects of spoken accent on working memory performance so that its implications in LTM and recall can be better understood and provide insight into learning in multicultural classrooms. Also, according to the 2007 American Community Survey taken by the U.S. Census Bureau, more than 55

million U.S. inhabitants spoke a language other than English at home. This is about 20 percent of the population of the United States and the number continues to grow. Also reported in the American Community Survey, 4.4% of the population ages 18-64 reported diagnosed cognitive disabilities. The National Institute on Deafness and Other Communication Disorders reported that approximately 6 to 8 million Americans have some form of language impairment (Shin & Kominski, 2010). As language diversity increases in the country, the language diversity of individuals diagnosed with cognitive or communicative impairments also increases. Understanding how language and spoken accent difference affects the accuracy of diagnostic testing becomes an important question. This study identifies if the increased diversity of spoken accent affects the test-taker's ability to recall spoken information.

A large challenge facing many professionals regarding testing and diagnosing English-Language Learner's with cognitive and/or language and learning impairments is distinguishing communication differences from communication disorders. In a web-based survey conducted by Kohnert et al (2003), 104 speech-language pathologists (SLPs) were surveyed and less than half had received professional training for working with culturally and linguistically diverse clients. The survey also indicated that assessment and intervention were the greatest challenges reported when working with bilingual clients. Finding other professionals who spoke the client's language was also reported as a challenge. Another survey of 213 SLPs found that one-third of these SLPs had not received training in multicultural and multilingual issues in their undergraduate nor graduate education (Hammer et al., 2004). Communication difference can effect many areas of testing. Some testing material can be culturally irrelevant to the client, meaning the client would be presented with words or scenarios in the exam that they may not have experienced or that they experienced, but interpreted differently. For example, many exams test social skills, which vary

greatly between cultures. While not making eye-contact with the test administrator may be an indicator of impaired social skills in the United States, many cultures find it rude to make eye-contact with authority figures. These cultural differences could cause a client to score poorly on a social skills test, which could lead the examiner to believe the client may be on the autism spectrum, when in reality they are just culturally different (ASHA, 2015)..

In order to protect against misdiagnosis of culturally and linguistically different individuals, the Individuals with Disabilities Education Act of 2004 provides guidelines for testing these individuals for qualification for speech and language services. The guidelines include the following:

1. Testing must be completed in the individual's native language as well as English.
2. The disorder must be present in the first and second language to qualify for services.
3. "Culturally unbiased evaluation tools" must be used.
4. An interpreter/translator must be present. (U.S. Department of Education, 2004)

While these guidelines are helpful in an ideal situation, they present some issues. First, ELL students and minorities are not well-represented in many standardized/norm-referenced tests. This makes it difficult to find standardized tests to administer that are "culturally unbiased." To qualify for services through Medicaid, two standardized or norm-referenced tests have to be administered by the speech-language pathologist. Because of this, many culturally and linguistically different students are administered tests that may misdiagnose their difference as disorder. Second, many schools do not have the resources to hire interpreters for every language spoken by their student population (ASHA, 2015). And even if an interpreter is used, they may not speak with the same native accent as the student. Questions of my study include:

1. Does spoken accent difference affect WM scores of the listener?

2. Does spoken accent difference of the professional administering diagnostic materials and the client affect the performance of the client during oral examination?
3. Could this effect lead to misdiagnosis of cognitive and communication disorders in culturally and linguistically different clients?

Methodology:

In this study, the Number Sequencing subtest in the Fourth Edition of the Clinical Evaluation of Language Fundamentals (CELF4) test and the Number Sequencing subtest of the Test of Auditory-Perceptual Skills- Revised (TAPS-R) were used to measure verbal working memory performance of 20 college students who speak and are predominately exposed to Mainstream American English. These number recall tasks were found to not be a good indicator of WM capacity, however, they remain a good measure of recall ability. This works well for this study as recall performance provides a realistic picture of how spoken accent difference affects listeners performance on a multitude of tasks. Participants were recruited through social media and personal/professional relationships and were given a survey to determine if they have the specific accent required for this experiment. Questions on the survey included:

What language does your family speak at home?

In what country did you spend the majority of your childhood?

The answers to these questions must be “English” and “the United States of America” in order for the individual to be a participant in the study. These tests assess an individual’s working memory performance through the ability to recall a verbal list of numbers forward and backwards. The assessment provides raw and standard scores of the individual’s performance according to naming accuracy. The test is designed to assess if an individual has an impairment in

working memory performance by comparing the individual's scores to the standard scores of typically developing individuals of ages 5 to 21. For the purpose of this study, the participants' raw scores will be compared from test 1 and test 2 to determine if there is a significant difference in recall ability between the two tests. Raw scores had to be used as the TAPS-R and the CELF4 were standardized differently. Each participant took each test administered by two different test administrators. Two male graduate students of similar age administered the test to each participant; one with a native language of Mainstream American English and the other with a native language of Kurdish. Both test administrators are proficient in English, though their spoken accents differ. The test administrators administered the test in the same way for each participant to maintain test validity. A minimum of five minutes and a maximum of thirty minutes was allotted to test each participant and, because there are two administrators, two tests will be administered at the same time. The administrator each participant saw for T1 was documented so that they could be assigned to the other administrator for T2. The participant's identity and scores were kept confidential. Each participant was assigned a number so that their test results correspond to that number. The test administered by the first administrator was labeled A and the test administered by the second administrator was labeled B. Each participant's results were in turn labeled by their corresponding number and the test administrator's corresponding letter. Once both tests were completed, the data corresponding the assigned numbers to all the participants' identities was securely removed in order to keep the data anonymous. Records are kept in a secured area. An incentive of donuts was given to participants before they took each test. This not only incentivized people to participate in the study, but also controlled inattentiveness due to hunger. The participants acted as their own control, meaning their scores from the two trials were compared

to identify if the spoken accent of the test administrator had a significant effect on their performance. The results were analyzed to determine if there is any significant effect and conclusions were drawn.

Results:

Based off of the participants' raw scores, there was not a significant difference in recall performance between the two test administrators. To determine this, I averaged the scores under each test administrator and compared the two results. Averages were calculated for the forward number recall tests, the reverse number recall tests, and the total scores. The averages for test-administrator A were 9.7 forward, 6.15 reverse, and 15.75 combined. The averages for test-administrator B were 9.5 forward, 6.3 reverse, and 15.8 combined.

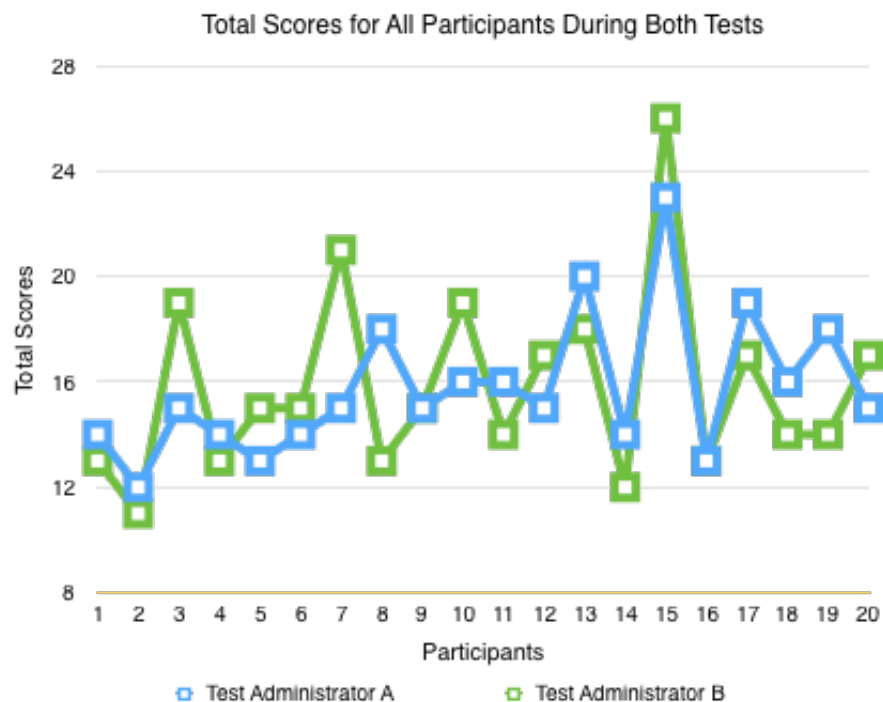


Figure 2. This graph displays each participant's scores from the tests administered by Test Administrator A and Test Administrator B. It visually provides a comparison of the scoring differences obtained from each administrator.

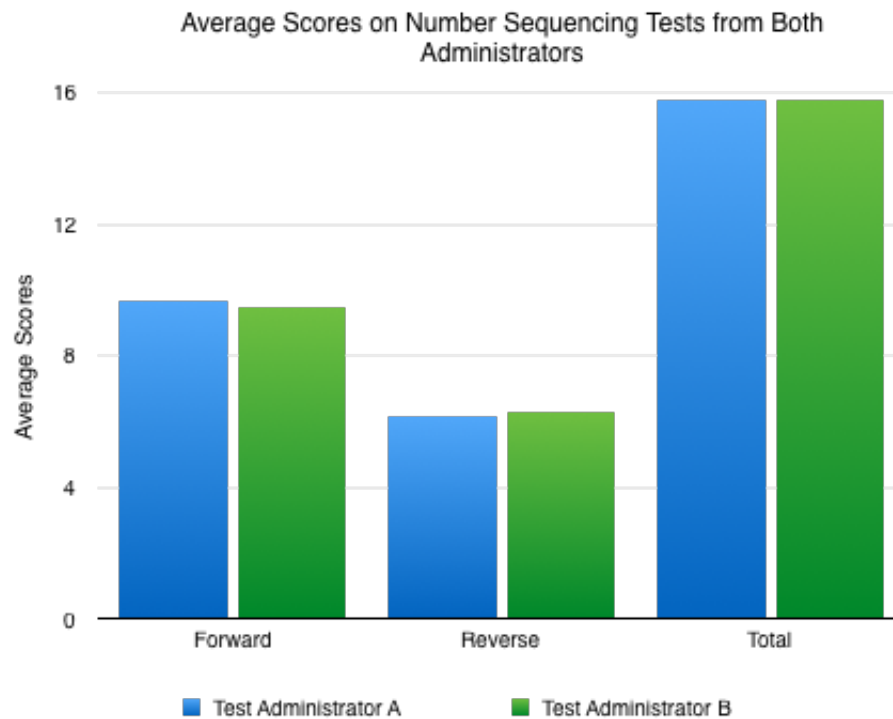


Figure 3. This chart compares the average scores obtained from the participants for the forward number sequencing test, the reverse number sequencing test, and the sum of the scores from these two tests. The averages for Test Administrator A and Test Administrator B are compared.

The differences between the averages of the test-administrators are almost non-existent so a statistical analysis was not necessary to compare the scores. The conclusion drawn from these results indicates that spoken accent difference of the test-administrator has no effect on recall ability of the test-taker during a number recall exam, though the sample size was not large enough to draw any hard conclusions.

Discussion:

There were many limitations to this study. First, the sample size and population of the participants was limited and lacked gender diversity. 17 of the 20 participants tested were female, which is not a good representation of the target population of this study. Also, the test materials used in this study were only standardized to age 21 and most of the participants were nearing the maximum age or surpassed it (Semel, Wiig, & Secord, 2003)(Martin & Brownell, 1996). This could mean that the test could not have produced meaningful data for a study of this nature. A typically developing 21-year-old should be able to perform well on this exam, which does not afford for many mistakes due to spoken accent difference. The test material also had high predictability for test-takers since it was a number recall test, which could have also contributed to the similarity in the scores between the two test administrators. Since there was a limited amount of information on this test (numbers 1 to 9), less cognitive load on the test-taker making it easier to guess or predict the correct answers. A test that contains more challenging, semantic information may be a better exam to test the effect of spoken accent difference on recall ability. These types of tests could include non-word repetition, unfamiliar word repetition, or short story recall. The results from all of these would provide a broader picture of how spoken accent difference affects test-takers.

Time was also a limitation in this study. Each test had to be administered to each individual participant, which took longer than initially expected. A time of 5 minutes per test was initially allotted in the research plans, however, each test took between 15 to 30 minutes. Around 30 participants showed up to the study, but only 20 could be tested in the time allowed for the experiment. Also, test administrator B took longer than test administrator A in administering his tests, which could have meant he was reading the list of numbers at a slower pace which could

have affected the recall performance of the participants. Because of the administration time difference, most of the participants saw test administrator A first. The interaction between first and second tests could not be measured because of this. This could also mean that participants were better primed for the second test (test administrator B) and therefore performed better on the test than they would have if they had gone to him first.

Future tests should be conducted to better understand the interaction of spoken accent and recall ability in listeners. Semantically loaded tests would provide a better picture of how well spoken semantic information is recalled by the listener when there is an accent difference between the speaker and listener. Another subject that could be interesting to test in the future is how spoken accent difference affects the test administrator and whether knowledge of their accent causes them to unconsciously provide assistance to the test-taker (i.e. extra time, primes, cues, etc.). A qualitative study could be conducted to measure whether speech pathologists think their accent affect client comprehension and if they use tactics to combat this effect.

APPENDIX A: Informed Consent Form

The Effects of Spoken Accent on Verbal Working Memory Performance

Principal Researcher: Faithe Snyder

Faculty Advisor: Kimberly Frazier

INVITATION TO PARTICIPATE

You are invited to participate in a research study about the effects of spoken accent on working memory performance during verbal exams. You are being asked to participate in this study because you are an English-speaking student at the University of Arkansas.

WHAT YOU SHOULD KNOW ABOUT THE RESEARCH STUDY

Who is the Principal Researcher?

Faithe Snyder

fasnyder@uark.edu

479-236-1432

Who is the Faculty Advisor?

Kimberly Frazier

kimfraz@uark.edu

479-305-4550

What is the purpose of this research study?

The purpose of this study is to assess whether working memory performance in listeners is significantly affected by the spoken accent of a speaker through the use of a verbal test.

Who will participate in this study?

50 University of Arkansas students.

What am I being asked to do?

Your participation will require the following:

You will listen to a test administrator read a list of words allowed, then repeat back the words that you remember.

You will retake this test one month from now with a different test administrator.

What are the possible risks or discomforts?

There are no risks associated with this research study and you will not be penalized in any manner if you choose not to participate.

What are the possible benefits of this study?

There are no anticipated benefits to you for participating in this study.

How long will the study last?

Each test will take a maximum of 30 minutes. You will be asked to take the test twice, once in August and once again in October, making the total experiment time for each participant no longer than an hour.

Will I receive compensation for my time and inconvenience if I choose to participate in this study?

Pizza will be provided before each test.

Will I have to pay for anything?

No, there are no associated costs related to participation in this research.

What are the options if I do not want to be in the study?

If you do not want to be in this study, you may refuse to participate. Also, you may refuse to participate at any time during the study. Your relationship to the University will not be affected in any way if you refuse to participate.

How will my confidentiality be protected?

All information will be kept confidential to the extent allowed by applicable State and Federal law. Each participant will be assigned a number so that their test results will correspond to that number. The test administered by the first administrator will be labeled A and the test administered by the second administrator will be labeled B. Each participant's results would in turn be labeled by their corresponding number and the test administrator's corresponding letter. Once both tests are completed, the data corresponding to the assigned numbers to all the participants' identities will be securely removed in order to keep the data anonymous. Records will be kept in a secured area.

Will I know the results of the study?

At the conclusion of the study, you will have the right to request feedback about the results by contacting Principal Researcher, Faithe Snyder at fasnyder@uark.edu, or Faculty Advisor, Kimberly Frazier at kimfraz@uark.edu. You will receive a copy of this form for your files.

What do I do if I have questions about the research study?

You have the right to contact the Principal Researcher or Faculty Advisor as listed below for any concerns that you may have.

Faithe Snyder: 479-236-1432

fasnyder@uark.edu

Kimberly Frazier: 479-575-4916

kimfraz@uark.edu

You may also contact the University of Arkansas Research Compliance office listed below if you have questions about your rights as a participant, or to discuss any concerns about, or problems with the research.

Ro Windwalker, CIP

Institutional Review Board Coordinator

Research Compliance

University of Arkansas

109 MLKG Building

Fayetteville, AR 72701-1201

479-575-2208

irb@uark.edu

I have read the above statement and have been able to ask questions and express concerns, which have been satisfactorily responded to by the investigator. I understand the purpose of the study as well as the potential benefits and risks that are involved. I understand that participation is voluntary. I understand that significant new findings developed during this research will be shared with the participant. I understand that no rights have been waived by signing the consent form. I have been given a copy of the consent form.

APPENDIX B: IRB Approval



Office of Research Compliance
Institutional Review Board

September 13, 2016

MEMORANDUM

TO: Faithe Snyder
 Kimberly Frazier

FROM: Ro Windwalker
 IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 16-07-024

Protocol Title: *The Effects of Spoken Accent on Verbal Working Memory Performance*

Review Type: X EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 09/13/2016 Expiration Date: 09/12/2017

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<https://vpred.uark.edu/units/rscp/index.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 50 participants. If you wish to make any modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

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